

The Economic Impacts of Increased Labor Productivity

A REMI Analysis of Increased Output in Missouri's Chemical Sector

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Key Findings

Economists argue that there are only two avenues by which states can increase their level of economic output: either through more labor effort applied in the production process (specifically, more jobs) or through increases in the productivity of the workforce. As labor force growth slows and unemployment remains at relatively low levels, states increasingly must look to productivity enhancements in order to maintain the high rates of output and income growth that have become commonplace over the past few decades.

Using the REMI economic model, MERIC studied the potential economic effects associated with an increase in labor productivity in the Chemical sector in Missouri, a sector vital to the state's economy. In general, this leads to a temporary decline in employment statewide: as the industry becomes more efficient, fewer employees are needed, resulting in lower income, which leads to less consumer spending, which leads to additional employment declines. However, these declines are eventually offset and exceeded by output and employment gains in the Chemicals sector and those industries that supply the sector with resources. These gains also lead to eventual increases in tax revenues for the state.

Clearly, then, increasing labor productivity is an important step for making economic gains in the state. Data demonstrates that productivity growth skyrocketed throughout the 1990s, as unprecedented technological advances made businesses more efficient.

Other research shows, however, that the labor force has been unable to keep up with growing technological demands. Thus, an even greater need for effective workforce training systems has developed as a result. Since greater workforce productivity benefits both business and government, the two entities should work more closely together in an effort to provide training for willing workers. Skills partnerships between industry, education centers, and governments are an excellent example of how such cooperation could be focused.

Either through skills partnerships, support of technological advancements, or through other means, policy makers must turn their attention to increasing the productivity of Missouri's labor force.

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Introduction

Recent years have seen a slowdown in the growth of the labor force, so state governments are being forced to explore other avenues to stimulate economic growth. This paper explores the potential economic impacts of labor productivity growth in the Chemicals Manufacturing sector, a New Economy industry often referred to as “Biotechnology” or “Life Sciences”. Through the use of the REMI economic model, it is shown that if labor productivity is increased, states will eventually experience employment and income gains, and key industries will become more profitable.

Stimulating a State’s Economy

Economists argue that there are only two avenues by which states can increase their level of economic output: either through more labor effort applied in the production process (specifically, more jobs) or through increases in the productivity of the workforce. As labor force growth slows and unemployment remains at relatively low levels, states increasingly must look to productivity enhancements in order to maintain the high rates of output and income growth that have become commonplace over the past few decades.¹

For much of the past half century, state economies have benefited from a massive increase in the number of people willing to work. As a rule, the pace of this increase has far outpaced population growth. This trend has been marked especially by the increased participation of minorities and women in the labor market. To a lesser extent, recent entitlement reforms have also increased labor force participation by providing greater incentives for individuals with low incomes to work.²

These trends are illustrated by events in Missouri. From 1980 to 2000, Missouri’s population grew from 4.9 million to almost 5.6 million, an increase of nearly 14%.³ In comparison, the labor force in Missouri grew from 2.25 million in 1978 to 2.97 million in 2001, an increase of 32%, a rate more than twice that of population growth. The unemployment rate, which peaked in Missouri in 1983 at 9.9%, dipped to a modern low of 3.4% in 1999, then rose in 2001 to 4.7%.⁴

The approach taken by most states to increase economic output, including Missouri, has been the first method listed above: create more jobs. Recent years have seen the popularity of “target industry” strategies among state and local governments, which is an attempt to find those industries that best match a region, and then encourage that industry’s growth. The fact that governments actually have a plan as opposed to the “shotgun” economic development styles of the past is encouraging. However, target industry strategies have now become

¹ McMullen, Mark, *Regional Productivity Matters*, October 17, 2001, as appearing March 28, 2002 on the website: <http://www.dismal.com/dismal/dsp/article.asp?aid=1418>.

² McMullen, Mark.

³ US Census Bureau.

⁴ Missouri Department of Economic Development

ubiquitous and are amazingly similar across states, causing many observers to question if these plans for increasing labor force participation will remain as effective in the 21st century.⁵

Clearly, then, state economies will not be able to rely as heavily on increases in labor force participation to stimulate economic growth. Thus, growth in labor productivity will become more instrumental in determining regional economic development prospects.

Chemical Manufacturing in Missouri

Chemical manufacturing (SIC 28, NAICS 325) is an important component of Missouri's economy. Unemployment Insurance (ES-202) data from 2000 indicates that over 25,000 people are employed in this industry in Missouri, earning an remarkable average of \$1,300 a week.⁶

Data supplied by Regional Economic Models, Inc. (REMI) further indicates the importance of the Chemical industry in Missouri. Employment data from the REMI model indicates that this industry is highly concentrated in Missouri relative to the rest of the nation, scoring a specialization ratio of 1.3.⁷ Specialization ratios in Chemical sub-sectors important to life sciences, such as Drugs and Agriculture Chemicals, are even higher. Even more indicative, Chemical manufacturing is directly responsible for almost 5% of Missouri's total economic output. Finally, Chemical workers are the third most productive workers in the state, producing an average of \$457,000 in output per year. (Average productivity for Missouri is about \$92,000 per year.)⁸

Economic Effects of Productivity Gains

Using the REMI model, MERIC studied the potential economic effects associated with a 1% increase in labor productivity in the Chemical Manufacturing industry in Missouri. Figure 1 presents the overall structure of the REMI model. By studying the figure, the general economic effects of productivity gains can be determined. For a complete description of the REMI model, please see the Appendix.

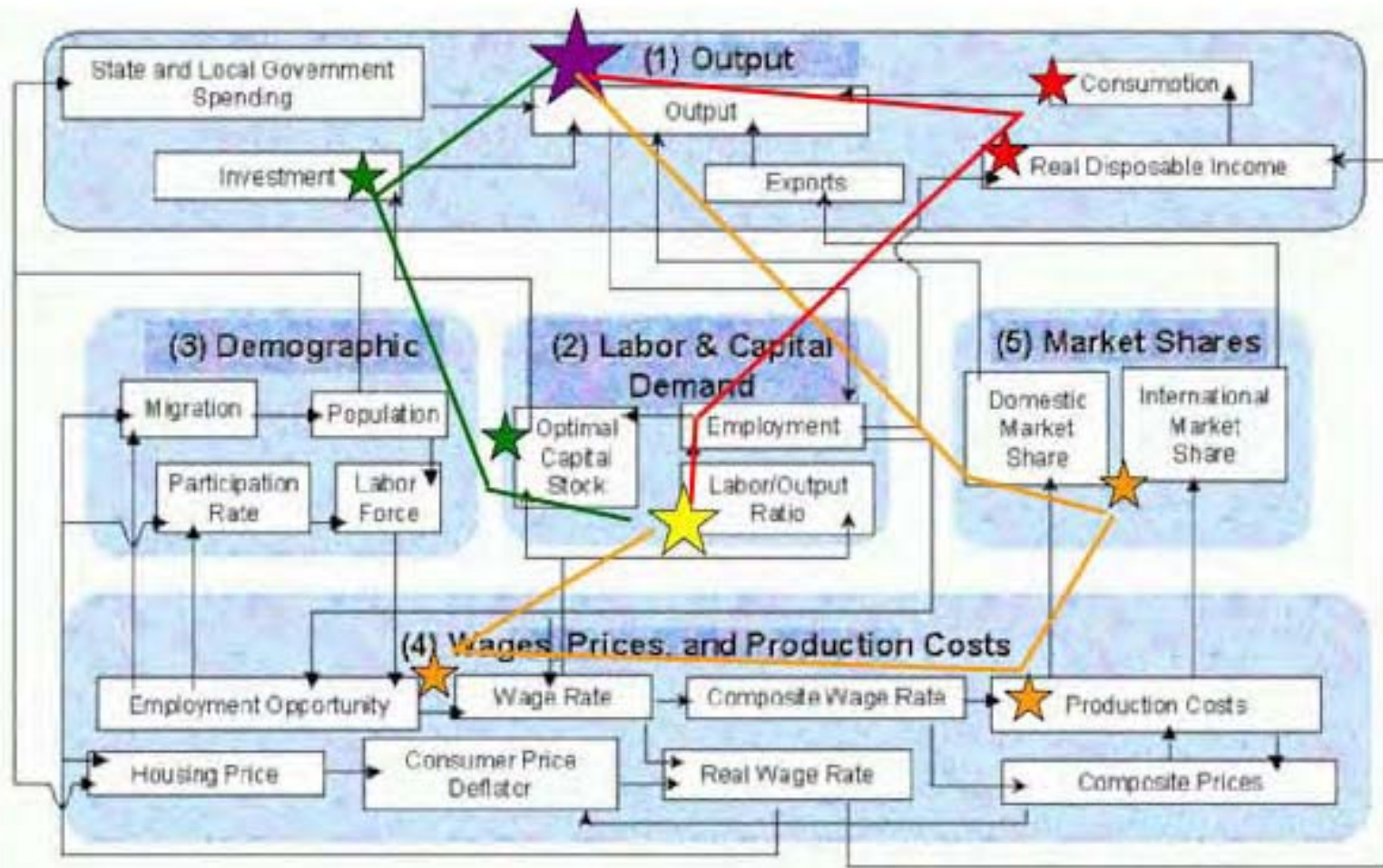
⁵ For example, Buss, Terry F., *The Case Against Targeted Industry Studies*, ECONOMIC DEVELOPMENT QUARTERLY, November 1999, pp. 339-356.

⁶ Missouri Department of Economic Development.

⁷ Specialization ratios compare an industry's share of local employment to the industry's share of national employment. Ratios greater than 1 indicate the industry is more concentrated in the region than the nation.

⁸ Regional Economic Models, Missouri Model, Version 4.0.

Figure 1. Interactions and Linkages in the REMI model



Source: REMI, Inc.

Labor Productivity enters the model in Block 2 of the diagram, indicated by the yellow star. An increase in productivity has a direct effect on employment in an industry: more productive employees mean that an industry needs fewer employees to maintain current levels of output. This drop in employment results in three major economic effects, as depicted in Figure 1.

1. (*Green Stars*) Since the Chemical industry needs fewer employees, firms in this industry can substitute spending on capital for spending on wages. Thus, demand increases for those industries that provide resources to the Chemical industry. These “intermediate demand” industries will increase output (and therefore employment) in an effort to meet this demand. Relatively large employment gains can be expected in industries that have both high intermediate demand from the Chemical industry, and large Regional Purchase Coefficients (RPCs)⁹ in Missouri. In this instance, these industries include Wholesale Trade, other Chemical firms, and Miscellaneous Business Services.
2. (*Red Stars*) Since the Chemical industry needs fewer employees, initial layoffs can be expected, which reduces disposable income in Missouri. Subsequently, consumer purchases will drop. It follows that those industries that rely heavily on consumer activity will be the most affected. Main components of consumer consumption include food & beverages, housing, medical care, professional services, recreation, household items and furniture, utilities, and several other wares. Therefore, demand for industries that produce these goods decreases, output diminishes, and further employment losses above the losses in the Chemical sector can initially be expected.
3. (*Orange Stars*) As a result of the drop in Chemical employment, the pool of available labor becomes slightly larger, which has an effect on wage rates for various industries in the state. This effect leads to further impacts on population and general employment in Missouri, as people search for higher paying jobs. Secondly, it makes firms in Missouri more profitable to operate, since production costs are now lower. This leads to increased output in certain industries, particularly the Chemical industry. This effect is relatively small compared to the previous two, but it has important implications for firms wishing to increase profits.

The net result from the labor productivity gain is an immediate overall decline in employment and income in Missouri, as Chemical firms become more efficient and consumer spending declines. In future years, these losses are erased and exceeded by economic gains, as Chemical output and profitability surges higher and output from intermediate demand industries also increases, leading to employment and income gains. These gains lead to improved consumer spending, and further gains in employment in Missouri.

⁹ The RPC for an industry is the proportion of the regional demand for a good or service that is fulfilled by regional production as opposed to being fulfilled by imports from another region.

First Year Impacts

Economic impacts during the first year following a 1% increase in productivity are generally negative. However, this is not unexpected, given the initial drop in overall employment predicted in the preceding section. The drop in employment leads to a large drop in personal income. However, overall economic output rises, primarily due to output increases in the Chemical sector. The Annual Wage Rate per worker in Missouri declines by \$1, which is arguably negligible.

Table 1 below summarizes these impacts, and gives an *approximation* of the contributing impacts of increased demand and decreased consumption, so the numbers will not sum correctly. In particular, note that the Output impacts of increased demand and decreased consumption lead to a drop of \$6 million, but the net effect of the productivity increase is +\$3 million. This is due to the large increase in Chemicals output as a direct result of the productivity increase.

Table 1.

First Year Economic Impacts	
Employment	-197
Impact due to Increased Intermediate Demand	+193
Impact due to Decreased Consumption	-336
Personal Income	-\$8,865,000
Population	-63
Output	+\$3,174,000
Impact due to Increased Intermediate Demand	+\$15,170,000
Impact due to Decreased Consumption	-\$21,970,000
Annual Wage Rate	-\$1

In general, increased intermediate demand increases employment in certain industries, while decreased income decreases demand and employment in consumer driven industries. Table 2, and the accompanying discussion and graphics, present these results in more detail for industries that experience significant impacts as a consequence of increased productivity in the Chemicals industry. The most important item to note in Table 2 is that total output in the Chemicals sector increases by over \$10 million, even though Chemicals employment drops by 93. This leads to a 0.2% increase in profitability for the Chemical industry in Missouri.

Table 2. Expanded First Year Economic Impacts

Industry	Employment	Output	Profitability
Chemicals	-93	\$10,180,000	0.2%
Printing	2	\$142,600	0.0%
Misc. Business Services	2	\$78,200	0.0%
Trucking	1	\$68,660	0.0%
Personal Services	-3	-\$88,690	0.0%
Education	-2	-\$89,650	0.0%
Public Utilities	0	-\$91,550	0.0%
Medical	-2	-\$94,410	0.0%
Auto Repair & Services	-1	-\$102,800	0.0%
Food Manufacturing	0	-\$106,800	0.0%
Insurance	-2	-\$107,800	0.0%
Amusement & Recreation	-2	-\$109,200	0.0%
Banking	-2	-\$151,600	0.0%
Credit & Finance	-2	-\$170,700	0.0%
Electric Equipment	-1	-\$170,700	0.0%
Communication	-1	-\$189,800	0.0%
Misc. Professional Services	-4	-\$210,300	0.0%
Non-Profit Orgs.	-7	-\$210,500	0.0%
Eating & Drinking	-9	-\$223,600	0.0%
Motor Vehicles	-1	-\$295,600	0.0%
Wholesale	-3	-\$354,800	0.0%
Machinery & Computers	-1	-\$390,100	0.0%
Real Estate	-3	-\$455,900	0.0%
Rest of Retail	-20	-\$1,040,000	0.0%
Construction	-32	-\$2,419,000	0.0%

In the Output Column, Blue indicates intermediate demand industries for Chemical Mfg., Red indicates high consumer demand industries, and Purple indicates those industries experiencing high demand from both Chemicals and consumers.

1. Increased Intermediate Demand

Because the Chemical industry is able to increase its capital purchases, those industries that supply the Chemical industry will experience increased demand. The industries most affected by this increased demand are given in the list below:

- Chemicals
- *Wholesale*
- Rubber
- *Misc. Business Services*
- *Printing*
- *Misc. Professional Services*
- *Trucking*
- Paper
- Fabricated Metals
- *Communication*
- Petroleum Products
- Food
- *Public Utilities*
- *Banking*
- Mining
- *Real Estate*
- *Railroad*

The industries denoted by italics indicate those that also have high RPCs in Missouri, so significant increases in output occur in these industries in Missouri as a result of increased Chemical production and capital purchases. These industries are indicated in Table 2 by blue and purple shading.

2. Decreased Disposable Income

Because of the reduction in personal income caused by employment declines in the Chemical industry, consumer spending initially declines. Those industries that are consumer driven experience a related decrease in demand, and therefore output, as a result. Those industries most affected by this decrease in demand are given in the list below:

- *Retail*
- *Wholesale*
- *Real Estate*
- *Medical*
- Petroleum Products
- Motor Vehicles
- *Communication*
- Food
- *Auto Repair & Services*
- Apparel
- *Public Utilities*
- *Eating & Drinking*
- Chemicals
- *Insurance*
- Misc. Manufacturing
- *Non-Profit Organizations*
- Electric Equipment
- *Banking*

The industries denoted by italics indicate those that also have high RPCs in Missouri, so significant decreases in output occur in these industries in Missouri as a result of decreased disposable income. These industries are indicated in Table 2 by red and purple shading.

3. Reduction in Wage Rate

The reduction in wage rate, although relatively small (only \$1 annually, according to Table 1), combined with increased output, work together to make the Chemical industry 0.2% more profitable as a result of productivity increases.

Long Term Impacts

As Chemical production increases and demand in intermediate industries intensifies, the economy quickly begins to recover. By Year 3, all of the employment lost in Year 1 is recovered, spurred by gains in Chemicals, Construction, Retail, Wholesale, Restaurants, and Business Services. By Year 5, 120 new jobs have been added to the economy above growth that is projected to have occurred had no productivity increase taken place. By Year 14, employment growth begins to slow, leveling off at around 260 new jobs in the economy. By this time, the Chemical industry has regained almost all of the employment lost due to initial declines. Table 3 displays this data in detail for those industries most affected by changes in intermediate demand and consumption.

Despite these employment declines, total economic output increases every year, led by skyrocketing output in the Chemical industry. In Year 1, total output increases by \$3.2 million, but output in Chemicals increases over \$10.2 million. Output gains quickly climb through Year 5 to \$52.0 million, with the Chemical industry responsible for \$38.6 million (74% of the increase). By Year 14, output growth levels off, with a gain of over \$90 million, with nearly two-thirds coming from the Chemical Sector. The only sector to experience relatively large declines in economic output is the Construction sector, which depends on large amounts of purchases from consumer driven sectors such as of Retail and Real Estate. However, even the Construction industry begins to experience positive economic output by Year 4. Table 4 displays this data in detail for those industries most affected by changes in intermediate demand and consumption.

Total personal income levels in Missouri decline during the first year of the productivity increase, driven by salary declines in the Chemical industry. However, personal income begins to recover in a parallel fashion to employment in the state, and begins to register growth in Year 4 after the productivity increase. By Year 14, growth begins leveling off, with the state receiving nearly \$18 million annually in new personal income. Over the period of the study, Missouri's average annual income gain is \$8 million, with a net present value of \$57.1 million.

These income gains have fiscal implications for the state of Missouri, with gains and losses in tax revenues following a pattern similar to that of Personal Income. Over the life of the study, MERIC estimates that the state will gain an average of \$511,000 each year, with a Net Present Value of \$3.5 million. More liberal revenue estimates generated by the REMI model indicate a potential annual average fiscal gain of \$1.2 million, with a Net Present Value of \$8.7 million. (The REMI model has a larger capacity to estimate changes in intergovernmental and transfer payments (e.g., welfare) as a result of population changes in the state.)

Table 3. Long Term Employment Impacts by Industry

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 10	Year 12	Year 14	Year 16
Chemicals	-93	-77	-63	-51	-42	-34	-23	-15	-10	-7	-5
Construction	-32	-19	-6	3	10	15	20	21	21	19	18
Rest of Retail	-20	-11	-3	3	7	11	15	17	18	18	18
Eating & Drinking	-9	-3	2	6	9	11	14	16	17	17	18
Non-Profit Orgs.	-7	-4	-1	1	2	3	4	5	5	6	6
Misc. Professional Services	-4	3	9	13	17	19	23	26	27	29	30
Wholesale	-3	5	11	15	18	20	23	24	24	24	24
Personal Services	-3	-1	1	3	4	4	5	6	6	6	6
Real Estate	-3	-1	1	2	3	4	6	7	8	8	8
Amusement & Recreation	-2	-1	0	1	1	2	2	2	2	2	2
Education	-2	0	2	4	5	6	7	8	8	8	9
Credit & Finance	-2	-1	1	2	2	3	3	3	3	3	3
Banking	-2	1	3	4	5	6	7	8	8	8	8
Insurance	-2	0	1	1	2	2	3	3	3	3	3
Medical	-2	-1	-1	-1	-1	-1	-1	-1	-1	0	1
Machinery & Computers	-1	-1	0	0	0	0	0	0	0	0	0
Auto Repair & Services	-1	0	1	2	2	3	3	4	4	4	4
Communication	-1	0	1	2	3	3	3	4	4	4	4
Electric Equipment	-1	0	0	0	0	0	0	0	0	0	0
Motor Vehicles	-1	0	0	0	0	0	0	0	0	0	0
Public Utilities	0	0	1	1	1	2	2	2	2	2	3
Food	0	0	0	0	1	1	1	1	1	1	1
Trucking	1	4	6	8	9	10	11	12	12	12	12
Printing	2	4	6	8	9	10	11	12	12	13	14
Misc. Business Services	2	14	23	32	39	45	53	60	63	64	66
Other Industries	-5	2	6	10	12	13	14	14	14	14	14
Total	-193	-88	0	67	120	158	207	238	252	259	264

Figure 2. Long Term Employment Impacts by Industry

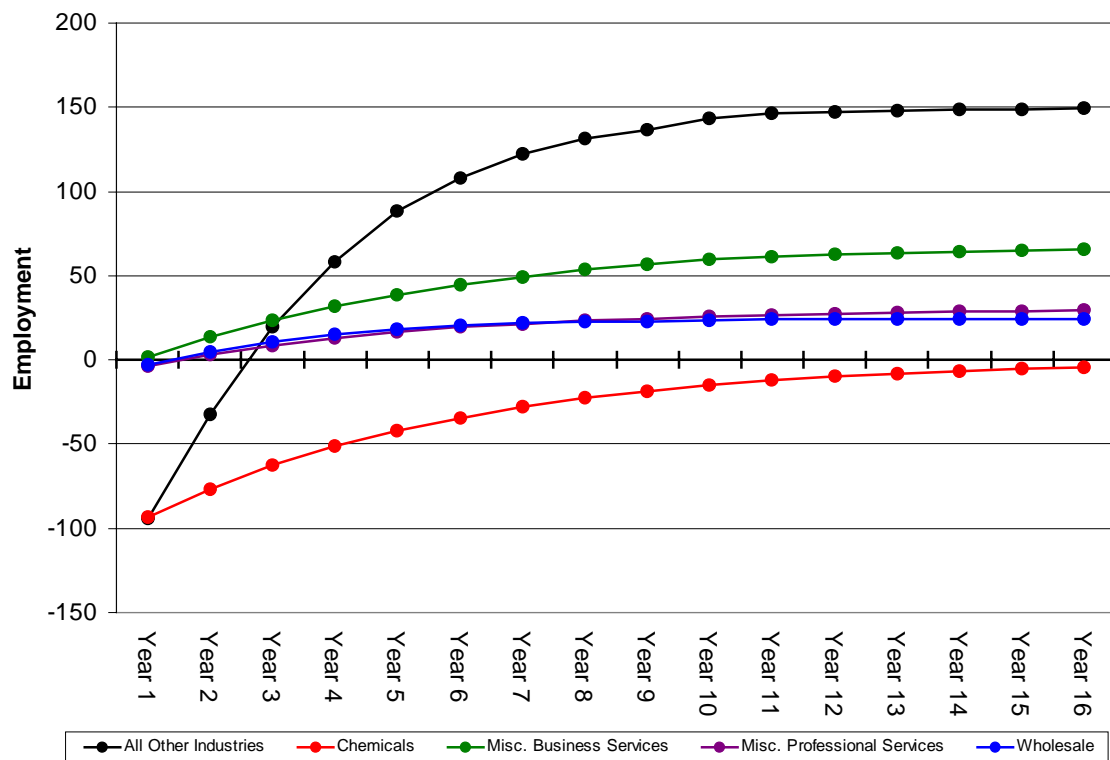


Table 4. Long Term Output Impacts (in \$M-92)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 10	Year 12	Year 14	Year 16
Chemicals	10.2	18.8	26.4	32.9	38.6	43.5	51.6	58.8	64.6	69.6	74.0
Printing	0.1	0.4	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.3	1.4
Misc. Business Services	0.1	0.6	1.1	1.5	1.9	2.3	2.8	3.3	3.6	3.8	4.0
Trucking	0.1	0.4	0.6	0.8	1.0	1.2	1.5	1.7	1.9	2.0	2.1
Personal Services	-0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Education	-0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.4
Public Utilities	-0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7
Medical	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
Auto Repair & Services	-0.1	0.0	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.5
Food	-0.1	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Insurance	-0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Amusement & Recreation	-0.1	-0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Banking	-0.2	0.1	0.2	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.1
Electric Equipment	-0.2	-0.1	0.0	0.1	0.1	0.1	0.1	0.0	-0.1	-0.1	-0.2
Credit & Finance	-0.2	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.6
Communication	-0.2	0.1	0.3	0.4	0.6	0.7	0.8	0.9	1.0	1.1	1.1
Misc. Professional Services	-0.2	0.2	0.5	0.7	0.9	1.1	1.3	1.5	1.6	1.7	1.8
Non-Profit Orgs.	-0.2	-0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Eating & Drinking	-0.2	-0.1	0.0	0.1	0.2	0.3	0.3	0.4	0.4	0.4	0.4
Motor Vehicles	-0.3	-0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Wholesale	-0.4	0.5	1.2	1.8	2.2	2.6	3.0	3.4	3.7	4.0	4.2
Machinery & Computers	-0.4	-0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.1	-0.1	-0.2
Real Estate	-0.5	-0.2	0.1	0.4	0.7	0.9	1.2	1.5	1.6	1.7	1.8
Rest of Retail	-1.0	-0.6	-0.2	0.2	0.4	0.6	0.9	1.1	1.2	1.3	1.3
Construction	-2.4	-1.4	-0.5	0.2	0.8	1.1	1.5	1.7	1.7	1.6	1.6
Other Industries	-0.2	0.4	0.9	1.2	1.4	1.6	1.7	1.7	1.8	1.8	1.8
TOTAL	3.2	18.5	31.7	42.8	52.0	59.6	71.3	80.9	88.2	94.3	99.6

Figure 3. Long Term Output Impacts (in \$M-92)

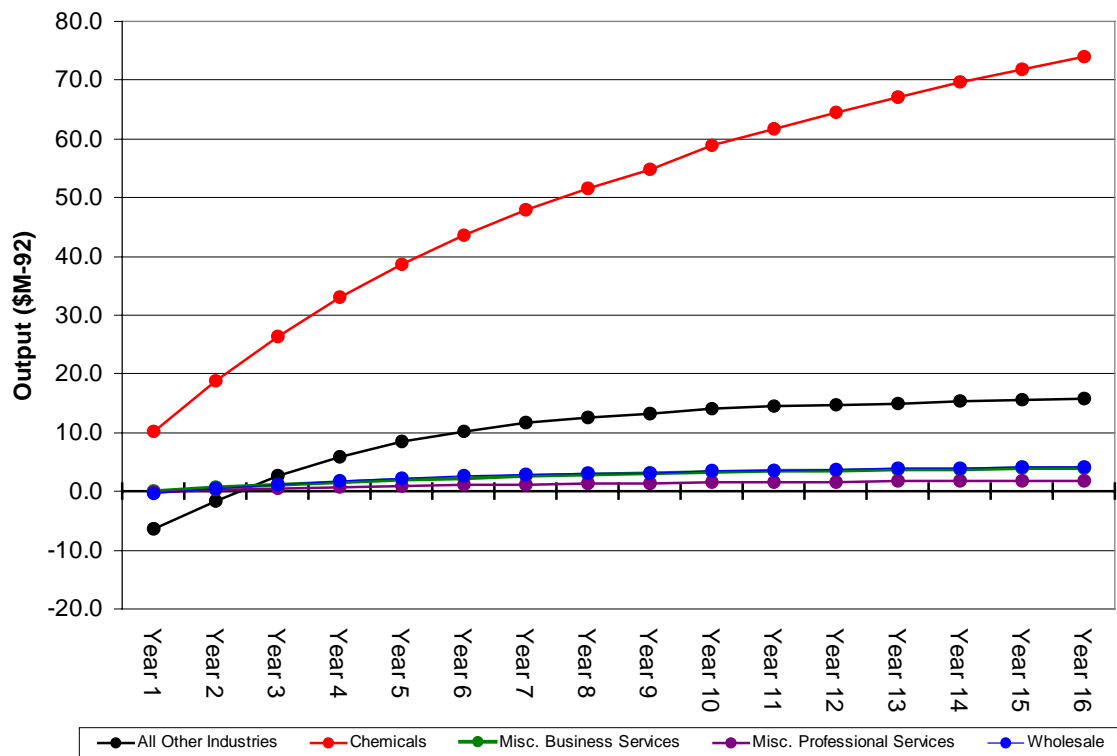
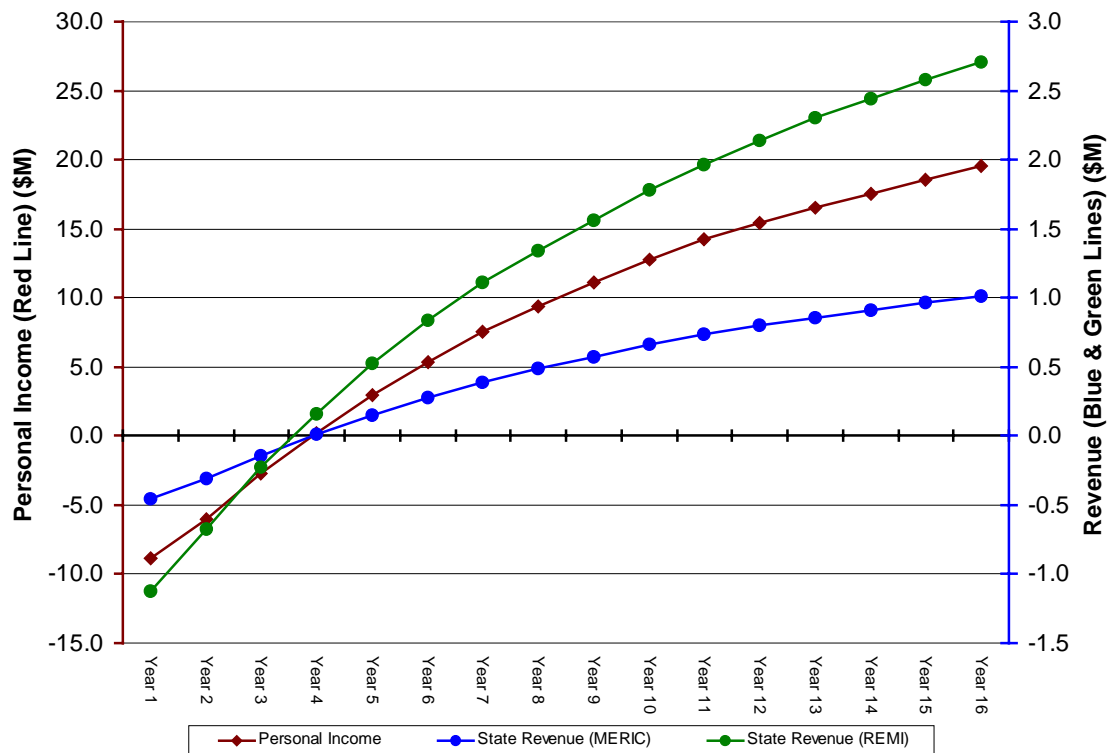


Table 5. Income and Revenue Impacts

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 10	Year 12	Year 14	Year 16
Personal Income (\$M-Nom)	-8.9	-6.0	-2.8	0.2	3.0	5.4	9.4	12.8	15.5	17.6	19.5
Annual Average	8.4										
Net Present Value	57.1										
State Revenue (MERIC) (\$M-Nom)	-0.5	-0.4	-0.2	0.0	0.2	0.3	0.6	0.8	0.9	1.1	1.2
Annual Average	0.5										
Net Present Value	3.5										
State Revenue (REMI) (\$M-Nom)	-1.1	-0.7	-0.2	0.2	0.5	0.8	1.3	1.8	2.1	2.4	2.7
Annual Average	1.2										
Net Present Value	8.7										

Figure 4. Income and Revenue Impacts



Achieving Productivity Gains

The evidence presented in the preceding sections demonstrates the importance of increasing labor productivity, even if in only one sector of a region's workforce. The next question, then, is how to achieve these productivity gains.

The most obvious answer, made so by the unprecedented growth of the 1990s, is to provide better technology to employees so that job operations become more efficient. Technological advances such as the personal computer, local and wide area computer networks, and telecommunications improvements have led to the creation of just-in-time inventory systems and other sophisticated business practices. Since 1995, productivity growth has averaged 2.2% a year in the United States, much higher than the average 1.4% growth in the 25 years before, and dwarfing productivity growth in the European Union.¹⁰

Even during the fourth quarter of 2001, a time of economic recession in the United States, productivity grew 3.5% from the previous quarter. (Average growth during a recession is 0.6%).¹¹ There is now growing consensus that the spread of information technologies around the globe has allowed productivity growth to occur in all economic sectors, not just computer or technology-based industries.¹²

However, it does little good for a company to make large investments in technology if its workers are unable to use the new gadgets. Research shows that more and more jobs are requiring higher levels of skill than in the past. Research also shows that the labor force, as a whole, has not adapted to the changes, resulting in low-skilled, low-waged workers. As it stands, firms lack qualified workers, employees lack the ability to get quality jobs, and governments are faced with the challenges of both.¹³

The Workforce Investment Act of 1998 (WIA) provides an avenue for change in state and local workforce development systems. States at the forefront of workforce development change have gone beyond the framework of the WIA and demonstrated innovative measures in skills assessment and training. From these innovations, several trends in successful workforce transformation have surfaced.

First, strong leadership and active involvement from the governor is necessary for successful workforce transformation. Second, states must create a unified workforce development system. Approaches to unifying systems include program consolidation, program coordination, developing and implementing performance indicators, and the creation of One-Stop Centers. Third, workforce development must be recognized as a core economic growth strategy. States

¹⁰ Bernasek, Anna, *The Productivity Miracle is for Real*, FORTUNE, March 18, 2002, pp. 84+.

¹¹ Cooper, James C., and Madigan, Kathleen, *Productivity: Galloping to the Rescue Once Again*, BUSINESS WEEK, February 18, 2000, pp. 29+.

¹² Editorial, *The Number to Watch: Productivity*, BUSINESS WEEK, February 18, 2002, pp. 116+.

¹³ Tesreau, Kerri, and Gielazauskas, Veronica, *Workforce Training in the New Economy*, MERIC research product, March 2002, <http://www.MissouriEconomy.com>.

must redefine the roles and focus of key agencies and departments, directing attention to training, retraining, attracting and keeping a qualified workforce.

Adopting a dual customer approach to workforce development is another trend in successful workforce development transformation. Employers and jobseekers must be treated as equal customers in the system. Changing employers' negative perceptions and involving them in workforce development systems is a necessary first step toward success.

Skills partnerships have arisen as a proven strategy in assisting low-income, low-waged workers in gaining employment and moving into higher level positions. Skills partnerships are industry-based partnerships that combine companies, educational institutions, training providers and interested community groups in an effort to address local and regional problems such as skill or worker shortages and a lack of career advancement opportunities for low-skilled workers.

Once in operation, skills partnerships greatly benefit local, regional and state workforces. Employers have access to the newly skilled workers, while workers begin to view low-skill, entry-level positions as starting points in a workforce development system that provides opportunities to increase their skills and advance their careers. Over time, a skills partnership will result in a system that is both more responsive to employers and that gives workers clear pathways for advancement through the labor market.

Conclusions and Policy Implications

The two easiest ways to increase economic output in a region are to increase labor participation, and increase labor productivity. The analysis presented in this study plainly demonstrates the benefits of increasing productivity, especially since recent trends clearly point to a tightening of the labor market in Missouri and elsewhere.

There is evidence to support the view that technological advances drive productivity growth, and not just in isolated economic sectors. Resilient productivity growth during the decade of the 1990s indicates that policy makers should investigate ways to help firms improve their technological capabilities.

However, it does little good to purchase machines that employees are unable to operate. Thus, government leaders should also investigate methods to promote workforce training, either through improved education or through solidly managed, unified workforce development systems.

Further, since it benefits both business and government to have a more productive workforce, partnerships between the two must be established to determine the most effective ways to increase productivity. An obvious arrangement is the skills partnership, through which employers have access to newly skilled workers and workers have opportunities to advance their careers.

No matter the method, policy makers must turn their attention to increasing the productivity of the labor force in order to ensure the continued growth of Missouri's economy.

Appendix: Description of the REMI Model

The REMI economic model uses hundreds of programs developed over the last two decades to build customized models using data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Department of Energy, the Census Bureau and other public sources.

The REMI model is a structural model, meaning that it clearly identifies cause and effect relationships. The model shares two key underlying assumptions with mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, the model can be understood by intelligent lay people as well as trained economists. In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside of the region. The output is produced using labor, capital, fuel and intermediate inputs. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor in the model determines the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in the cost of doing business causes either an increase in price or a cut in profits depending on the market for the product. In either case, an increase in cost would decrease the share of the local and US market supplied by local firms. This market share combined with the demand described above determines the amount of local output. Of course, there are also many other feedbacks in the model such as the feedback from changes in wages and employment to income and consumption, the feedback of economic expansion to investment, and the feedback of population to government spending.

MERIC uses two separate REMI models in its analysis efforts. The model used for this report is a single-region model of the state of Missouri. Other reports, particularly those used for economic development studies, are completed using a multi-region REMI model customized for Missouri's 15 economic regions together with outlying metro areas in Kansas and Illinois.

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